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# ECONOMICS



## MONOTOWNS: A QUANTITATIVE ANALYSIS

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*The authors propose an empirical analysis of the current situation in monotowns. The study questions the perceived seriousness of the 'monotown problem' as well as the actual challenges it presents. The authors use cluster analysis to divide monotowns into groups for further structural comparison. Since structural differences in the available databases limit the possibilities of empirical analysis, alternative approaches are required; the authors consider possible reasons for the limitations identified. Special attention is paid to the monotowns that have been granted the status of advanced development territories. Comparative analysis makes it possible to study their general characteristics and socioeconomic indicators. The authors apply the theory of opportunistic behaviour to describe potential problems caused by the lack of unified criteria for granting monotowns the status of advanced development territories. The article identifies the main stakeholders and the nature of their interaction; it describes a conceptual model built on the principal-agent interactions, and draws a possible scenario of mutually beneficial cooperation. The solution to the principal-agent problem suggested in the article contributes to the development of an alternative approach to the current situation and a rational approach to overcoming the 'monotown problem'.*

*Key words:* monotown, single industry town, institutional agreement, cluster analysis, information asymmetry

### Introduction

Issues pertaining to managing monotowns by way of either ensuring their viability or choosing a different development path are becoming increasingly relevant. While this phenomenon is often perceived as an exclusively Russian

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problem, it became the focus of public attention in other countries much earlier than in Russia. Already in the 1960s, the US and some European countries were looking for different solutions to socioeconomic problems of monotowns [21]. In Russia, special attention to the monotown problem is determined by the general conditions of socioeconomic development, with the 2008—2009 crisis being a vivid example. In this period, the country witnessed growing willingness to protests among the general public and an increased attention to monotowns from politicians and mass media, as well as resumed construction of new factories [4]. Yet a comprehensive assessment of the monotown situation is hindered by the lack of relevant information. Despite the availability of a regularly updated governmental list of monotowns, most of the data necessary for a high-quality analysis is difficult to obtain, and statistics provided by Rosstat (Federal State Statistics Service), whose online database is often used to assess the conditions and prospects of socioeconomic development of monotowns, is hardly sufficient. This does not mean that we cannot advance in empirical studies. This article aims to propose approaches to a quantitative analysis of socioeconomic situation in monotowns, based on available information and taking into account incentives to rent-seeking behaviour.

The structure of the paper is as follows. The first part of the article describes elements of cluster analysis as applied to a monotown sample in view of the existing information limitations. The second part focuses on variables and the results of clustering. The third part considers development problems of monotowns as advanced development territories in the context of rent-seeking behaviour. Key results are summarised in the conclusion.

## 1. An approach to cluster analysis of monotowns

At first, the authors of this article attempted to address the socioeconomic situation in monotowns using the cluster analysis. Monotown clusters with similar structure were to be identified based on a statistical data analysis, followed by the development of a special approach to examining the situation in each cluster. However, in practice, an analysis of statistical data proved rather complicated. In April 2015, the list of monotowns was extended once again [13] and its structure changed. All monotowns were now divided into three categories. Each included both large cities with a population of over 500,000 people and small villages with several thousand residents. But is such classification justified? Does it allow us to take into account all structurally significant factors?

In keeping with the initial homogeneity criterion<sup>1</sup>, it was decided to analyse qualitative characteristics of monotowns in the first category, i. e. those most sensitive to socioeconomic changes. The following parameters were chosen as benchmarks.

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<sup>1</sup> The homogeneity criterion is understood as monotowns retaining their positions in initial categories. However, there is a possibility that monotowns can be further classed within each of the three categories. If further classification is possible, an analysis will be simplified, since it will become possible to choose a methodology for managing monotown risks.



1. *Fixed assets investment* — expenditure on buildings and other means of production. This parameter should be taken into account, since the risk of principal employer's facilities becoming obsolete is widely discussed in literature. It would be interesting to understand whether fixed asset investment (in the context of building) affects the balance sheet of a municipality<sup>2</sup>.

2. *Local budget revenues, including non-repayable receipts* — a parameter determining the potential size of funds transferred to a municipality for purposes and functions within the agent's competence. Using this parameter is necessitated by the fact that an assessment of the socioeconomic situation in a monotown requires information about the size of funds available to the municipality.

3. *Personal income tax* is a direct tax calculated as a percentage of the total income of persons, with due exemptions. This parameter should be used to compare monotowns based on expected income of residents.

4. *Revenues from using public and municipal property* are a parameter determining the revenue associated with the exploitation of public property. It is necessary for assessing the reasonableness of expenditure on putting property online.

5. *Environmental damages* are compensation for environmental pollution. Environmental risk is often mentioned as a risk associated with monotowns. It is evident that monotowns, whose viability depends on the extraction industry, are more susceptible to this risk than those dominated by the processing industry<sup>3</sup> are.

6. *Municipal social policy spending* is the part of municipal budget allocated to support the welfare of citizens. This parameter is included into the analysis to estimate expenditures on maintaining the required socioeconomic level.

7. *Population* is the number of citizens living in a monotown. This parameter should be taken into account in comparing the specific amount of expenditure in view of the population size.

Ninety tree first category monotowns were analysed using the SPSS analytics software. However, it was not possible to classify all 319 monotowns by cluster due to two reasons. Firstly, as mentioned above, it would be inappropriate to compare densely populated towns and villages with few thousand residents. Secondly, statistics available on official websites does not make it possible to form clusters for analysis — for instance, some of the Volga region towns regularly update statistics, whereas some Siberian towns present no information at all. Moreover, the incompleteness of available data complicates a panel analysis for the chosen period (2007—2014). At the same time, a panel analysis seems to be crucial, since the increased attention to the monotown problem observed in crisis periods requires assessing the similarity of monotowns' reactions to external shocks.

<sup>2</sup> The authors realize that this parameter is not sufficient to demonstrate municipal expenditure on fixed asset maintenance. However, since the Rosstat website does not present any more appropriate data, it was decided to use this parameter adding an error function, when conducting a cluster analysis.

<sup>3</sup> However, environmental risks are a significant threat in both types of monotowns.

Therefore, it would be logical to make the sample as homogeneous as possible to increase its qualitative representativeness and retain the possibility of checking its structural elements after clustering. It was decided to consider towns with a population of over 100,000 people. Generally, in such towns there are other employers, apart from the principal one. However, according to the governmental monotown list, they are divided into categories depending on the socioeconomic situation. Therefore, it is proposed to conduct a cluster analysis to estimate the homogeneity of characteristics underlying such a classification. If the towns comprising a cluster have similar characteristics, they should probably be monitored using a certain scheme. If it is not the case, it is important to consider the cause-effect relations behind the homogeneity divergences between towns belonging to one cluster both in model and in reality.

## 2. Description of variables and the analysis

23 towns were selected from the governmental list, based on the following criteria:

- a population of over 100,000 people;
- town statistics available at [www.gks.ru](http://www.gks.ru) in the *Russian regions. Major socioeconomic indicators of towns — 2014* reference book.

The following variables were treated as explanatory variables (all variables were standardised during the analysis):

**I** stands for fixed assets investment. This variable is entered as an explanatory variable, since it reflects expenditure on reproducing fixed assets, which is especially relevant in the case of monotowns, where the depreciation of fixed assets and the absence of their reproduction remain major obstacles to the performance of monotowns' major employers.

**F** stands for the number of organisations engaged in manufacturing. This variable is included, since most monotowns specialise in extracting and/or manufacturing.

**P** stands for local population. This parameter is instrumental in detailing the scale of problems in a monotown. It also serves as a criterion for selecting monotowns for analysis (those with a population of over 100,000 people). It is evident that partial resettlement followed by economic diversification and relevant initiatives will be more probable and less painful to residents of a monotown with a population of approximately 100,000 people than in a monotown with that of over 200,000 residents.

**L** stands for working-age population. The variable is necessary for assessing performance potential in a monotown.

**U** is the number of non-working citizens registered with the employment office and officially recorded as unemployed. This variable is necessary for estimating the pressure on the welfare and social support system.

**AS** stands for average nominal gross salary (roubles). It is necessary for estimating the average monthly income of a monotown's population and identifying its principal industry.

**Cr** stands for the registered crime rate. This variable makes it possible to assess the level of potential socioeconomic tension in the town.

**Cat** is the category assigned to a monotown in the governmental list (1, 2, or 3).

Of course, these variables do not fully reflect the relevant aspects of socioeconomic situation in monotowns. It would be more practical to use the overall crime rate, since the registered crime rate can distort the actual picture. This is especially true in the cases when the ratio between the two types of crime is skewed towards unregistered ones. Another example is the nominal gross salary. This parameter is one of the most available for a quantitative assessment. However, it can hardly be used if one focuses on changes over time rather than those within a certain period. Moreover, a more accurate evaluation of this parameter requires understanding the extent of the effect of distorting factors — outside earnings and temporal consumption structure (i. e. changes in consumer debts).

After selecting variables using the SPSS analytics software, a cluster analysis yielded the following classification.

Cluster	Town
Cluster 1	Neftekamsk Dmitrovgrad Novocheboksarsk Severodvinsk Kaspiysk Nevinnomyssk Belovo Leninsk-Kuznetsky Mezhdurechensk Prokopyevsk Kamensk-Uralsky Pervouralsk Serov Zlatoust Miass
Custer 2	Tolyatti Novokuznetsk
Cluster 3	Naberezhnye Chelny Cherepovets
Cluster 4	Nizhnekamsk
Cluster 5	Norilsk
Cluster 6	Nizhny Tagil Magnitogorsk

Let us consider each of the clusters and try to understand whether the classification criteria match the reality.

### *Cluster 1*

Cluster 1 towns divided into categories<sup>4</sup>:

Category 1	Category 2	Category 3
Kaspiysk Prokopyevsk Pervouralsk	Neftekamsk Nevinnomyssk Belovo Leninsk-Kuznetsky Mezhdurechensk Kamensk-Uralsky Zlatoust Miass	Dmitrovgrad Novocheboksarsk Severodvinsk Serov

According to the database, towns belonging to category 1 of cluster 1 meet the following criteria:

Population of 105—202 thousand people.

Number of the employed ranging from 68 to 113 thousand people.

Fixed assets investment from 1,442 to 2,996 thousand roubles.

Average nominal gross salary from 17,283 to 26,357 roubles.

Category 2:

Population of 101—173.3 thousand people.

Number of the employed ranging from 57.4 to 97.9 thousand people.

Fixed assets investment from 842.5 to 11,629 thousand roubles.

Average nominal gross salary ranging from 21.693 to 33.416 roubles.

Category 3:

Population of 107.2—188.4 thousand people.

Number of the employed ranging from 61.3 to 112.3 thousand people.

Fixed assets investment from 4124.6 to 7328.1 thousand roubles.

Average nominal gross salary ranging from 20711.8 to 36983.4 roubles.

In general, monotowns constituting this cluster have similar characteristics. When analysing the monotowns by categories, one can see that there is no significant difference in values. Therefore, such classification can be built and applied in practice<sup>5</sup>. A general solution to the ‘monotown problem’ can be found at least for the cluster under consideration. In this case, one should answer the question as to what difference is significant and based on what criteria it can be acknowledged as such. Moreover, although the population of monotowns comprising the cluster, the number of the employed, and the

<sup>4</sup> According to Governmental Decree 668-r of April 16, 2015, monotowns of the first category are characterised by the most difficult socioeconomic situation, the second by risks of the situation deteriorating, and the third by a stable socioeconomic situation.

<sup>5</sup> It is possible to create a completely accurate classification due to structural flaws of explanatory variables. At least, when building a mode, some variables are used twice, for instance, if the population or the number of the employed are considered.

average salary are comparable, fixed assets investment raises a number of question, For instance, in category 2 monotowns, it is even smaller than in category 1, although it should apparently be vice versa. Is this situation a result of production diversification in category 2 monotowns, which can be corroborated by smaller municipal expenditure on fixed assets reproduction? Is it a result of distorted statistics? It is also possible that some monotowns comprising category 2 would be classed as category 1 in the case of an alternative combination of socioeconomic factors?

### **Cluster 2**

Cluster 2 is comprised of two towns — Tolyatti of category 2 and Novokuznetsk of category 1. The population of Tolyatti is 718 thousand people, whereas that of Novokuznetsk 550 thousand people. At least in terms of population, these towns belong to the same category. In Tolyatti, the number of the employed is 435 thousand people and, in Novokuznetsk, 328 thousand. In both towns, an almost identical percentage of population can be classed as employed. However, in Tolyatti, fixed assets investment reaches 35098.4 thousand roubles and the average salary 26006.6 roubles, whereas in Novokuznetsk, it is 17719.1 thousand roubles and 28980.2 roubles respectively.

The principal employer in Tolyatti is AvtoVAZ and, in Novokuznetsk [6] EVRAZ. It is worth stressing that, whereas Russia's car market is in the state of stagnation (table 1), the country's metallurgy market is developing [5; 8].

*Table 1*

#### **A review of Russia's car market**

Category	Sales, thousand units			Sales, billion roubles		
	January-September		Difference	January-September		Difference
	2015	2014		2015	2014	
Russian car makes	193	295	– 34 %	96	121	– 21 %
International makes produced in Russia	519	846	– 39 %	600	822	– 27 %
New imported cars	238	527	– 55 %	349	632	– 45 %
Total	950	1667	– 43 %	1045	1574	– 34 %

Source: [1].

### **Cluster 3**

Cluster 3 brings together such towns as Naberezhnye Chelny and Cherepovets. Both are classed as category 1 in the governmental list. The population size is similar in both towns — 522 thousand people in Naberezhnye Chelny and 316.8 thousand people in Cherepovets. The employment rate in Naberezhnye Chelny is 61.3 % (320 thousand people), and in



Cherepovets 60.4% (191.1 thousand people). Fixed assets investment is almost identical in these monotowns — 20,679 thousand roubles in Naberezhnye Chelny and 22,098 thousand roubles in Cherepovets. As to the average salary, just as in the other clusters, the values are markedly different — 25,949 roubles in Naberezhnye Chelny against 36,436 roubles in Cherepovets.

It is of interest that both towns are classed as category 1. However, in the case of Cherepovets, 880 million roubles were allocated for the construction of the Cherepovets industrial park [10]. Today, the project includes the construction of a fibrewood panel factory, a gypsum plant, and a pipe plant.

A 2015 governmental decree included Naberezhnye Chelny in the list of monotowns that were granted an advanced development territory (ADT) status [18]. Today it is difficult to assess a town's prospects of acquiring the ADT status, despite tax privileges for business, since the lorry market (Naberezhnye Chelny's principal employer is KamAZ — Russia's largest lorry producer) is very sensitive to fluctuations in the economy. However, international practices of overcoming 'monotown crises' when applied to companies working on ADT suggest that tax privileges contribute to the development of small and medium businesses in a town. Therefore, such initiatives will increase Naberezhnye Chelny's chances of leaving the category of the most depressed monotowns.

#### *Cluster 4*

A special case is cluster 4 consisting of only one town — Nizhnekamsk [10], which is classed as category 3. The key parameters analysed in this cluster are as follows:

Population — 235.6 thousand people.

Number of the employed — 146.6 thousand people.

Fixed assets investment — 41113.2 thousand roubles.

Average nominal gross salary — 28892 roubles.

The results are somewhat contradictory. Based on the population size and salary, Nizhnekamsk could be classed as cluster 1 (category 3). However, it is not the case due to fixed assets investment being the largest in the sample.

#### *Cluster 5*

It is another cluster consisting of only one town — Norilsk, which is also classed as category 3.

Population — 1,773 thousand people.

Number of the employed — 126.1 thousand people.

Fixed assets investment — 42,881.9 thousand roubles.

Average nominal gross salary — 66,584 roubles.

It is not a coincidence that this cluster comprises only one monotown. When analysing the selected parameters, one can see that the socioeconomic situation in this town is very different from the others. Firstly, the employment rate in Norilsk is much higher than in the other monotowns (above 70%). This is accounted for by the principal employer — Norilsk Nickel —

being a major company and Norilsk the region's second largest city after Krasnoyarsk. Secondly, the values of such parameters as fixed assets investment and salary are much higher than in the other towns, sometimes it is a 1.5—2.5-fold difference.

In other words, the situation in Norilsk is rather stable and favourable. Of course, the reason behind it is the success of the principal employer — the Norilsk Nickel mining and smelting company. In the crisis 2008—2009 years, the company's top priorities were to avoid lay-offs and maintain social stability in the regions of operation [8; 26]. Probably, these priorities helped Norilsk to recover quickly from the crisis. However, local authorities also contributed to overcoming the effects of the 2008—2009 crisis.

In 2010, a modernisation plan for the town of Norilsk was published on the website of the Krasnoyarsk region [6]. The plan was aimed at securing a stable economic development of the town. Local authorities stressed that the viability of the principal employer, its operation, and thus favourable living conditions depended on solving a number of housing and utility problems and the prospects of resettling the non-productive population of Norilsk. This framework gave rise to projects capable of ensuring industrial modernisation and diversification and solving a number of social security issues.

Some measures suggested launching an investment project for mine development, modernisation of housing, water treatment facilities, and urban infrastructure, resettlement within a target resettlement programme, creation of social infrastructure, and opening a landfill site. According to the plan, the projects are to be completed in 2025, thus interim results are not yet available.

### *Cluster 6*

Cluster 6 comprises such towns as Nizhny Tagil and Magnitogorsk, both classed as category 3. The population of the first town is 360.7 thousand people and that of the second 414.9 thousand. The number of the employed is 209.9 thousand people in Nizhny Tagil and 246.8 thousand in Magnitogorsk. Fixed assets investment in Nizhny Tagil is lower than in Magnitogorsk — 12,838 thousand roubles and 17,314 thousand respectively. As to salary, the difference is smaller — 28,643 roubles in Nizhny Tagil and 31,429 roubles in Magnitogorsk. The towns are engaged in the same industry. The principal employer of Magnitogorsk is Magnitogorsk Iron and Steel Works specialising in black metallurgy. Three major companies operating in Nizhny Tagil are EVRAZ (metallurgy), Vysokogorsky mining and processing works (iron ores), and Uralvagonzavod (arms industry).

### **3. Advanced development territories in monotowns — development initiatives or stimuli for rent-seeking behaviour?**

It is important to stress that this sample includes towns that were granted the advanced development territory (ADT) status [2]. As of September 2015, ADT monotowns [17] include Usolye-Sibirskoe (Irkutsk region), Gukovo (Rostov region), Yurga (Kemerovo region), and Naberezhnye Chelny (Re-

public of Tatarstan). The law grants ADT towns a number of privileges — special legal regimes for business and other activities (rent exemptions, tax privileges, and special regimes of public and municipal control) and withdrawal of land for ADT buildings and infrastructure [2].

Let us consider the four ‘newcomers’ on the monotown list and analyse them from the perspective of homogeneity of socioeconomic situation in the town (table 2).

Table 2

### Socioeconomic characteristics of ADT towns

Town	Unemployment rate, %	Fixed capital investment from the municipal budget, roubles	Average salary, thousand roubles	Industrial production index, %	Proportion of SME revenues
Usolye-Sibirskoe	1.21	23.6 million	20.9	62.7	52.4%
Gukovo	1.2	262.9 million [13]	17.3	...	...
Yurga	2.25 [1]	718.6 million [14]	17.9	96.6 [14]	No data. There is information that the proportion of tax revenues is approximately 22 % [14]
Naberezhnye Chelny	0.81	37,700 million	25.9	96.4	49,000 million roubles [15]
National total	5.2	396,000 million	32.5	101.7 [9]	—

Source: compiled by the authors based on information from municipalities’ official websites.

There are evident differences. Firstly, only one of the four towns — Naberezhnye Chelny — has a population of over 100 thousand people. Of course, this affected the parameter values. However, the other three monotowns show similar performance. A special case is Usolye-Sibirskoe, where fixed assets investment and industrial production index are at the lowest. It is important to take into account not only the obtained values but also the complications relating to data collection.

The discrepancy between the data available on the Rosstat and town administration websites ([www.gks.ru](http://www.gks.ru)) suggest that the fixed assets investment in Usolye-Sibirskoe is 23.6 million roubles, whereas, according to the administration website, it is 803.8 million roubles, including 1.1 million rouble investment in construction),

— The lack of necessary data on the websites of state statistics services and town administration (the town of Gukovo).

— The impossibility of comparing data due to initial structural differences characteristic of the selected parameters.



That is why, a structural analysis of ADT monotowns is just a ‘first glance’ at their composition, similarities, and differences. In view of the fact that these monotowns specialise in different industries and that they were granted the ADT status not a long time ago, it is difficult to suppose what effect this privileged status will have in the future. In this case, the most appropriate approach would be ‘difference in difference’, which will make it possible to predict how the ‘special status’ monotowns will develop as compared to other monotowns. How significant will that difference be?

Another interesting issue is how the other monotowns with a structure similar to ADT towns will react to these privileges. Does it mean that monotowns will work towards acquiring the coveted status? If the socioeconomic situation in a monotown is similar to the national average and this town is granted the ADT status, why is not this status granted to all other towns showing a similar performance? How will it be possible to evaluate the actual situation in a monotown? Are there any guarantees that the situation in an ADT monotown will change for the better? Moreover, the ADT status suggests production diversification, which necessitates retraining the staff and requires additional spending.

These considerations compel one to rephrase the question. Is not it reasonable to discuss this problem parametrically, taking into account that we are dealing with the system of relationships with the information asymmetry. In this case, we should consider both the problem of veracity (and timely submission) of necessary data and that of the ‘privileged’ position of selected monotowns. It is important to mention that an attempt at modelling was made earlier [20] when discussing an institutional agreement modelling. The reference point is the reasonability of continuing a principal employer’s operations accompanied by resettling, changing specialisation due to the transfer of assets from specific to general, or regular monitoring if maintaining specialisation is justified. However, such institutional agreements work only if the problems arising from information asymmetry are solved.

Let us examine the same agreement in terms of information asymmetry. Technically, we are solving the principal-agent problem with the reservation that the principal (the non-informed party) is a federal authority whereas the agent (the informed party) is the management of a monotown’s dominant company. However, the system contains another element — regional authorities, which act as an agent for the mentioned principal and a principal for the agent presented by the company’s management. In this case, the regional authorities are the key element of the system, since they serve as a mediator<sup>6</sup> between the major principal and the agent.

Let us suppose that the management of the dominant company is interested in maximising its profit:  $\pi_i \rightarrow \max$ , where  $\pi_i$  is a certain function of  $n$

<sup>6</sup> We understand that there is a possibility that the beneficiaries of a dominant company can address the federal centre directly. However, this variant suggests an interaction between the agent and the regional principal. When it comes to financing, agents will either fulfil their obligations or not, however, the principal does not have this information at the moment.

variables, including assets specificity, selling price, parameters of fixed and variable costs, etc. The management of a dominant company can receive a certain amount of investment  $f$  from the federal level for implementing a certain project expected to have a positive effect on a company's profit and, supposedly, the socioeconomic position of the  $i^{\text{th}}$  monotown under consideration. However, an agent prone to rent-seeking behaviour [22; 24] can doctor information reporting a difficult financial situation to the regional authorities, which, in their turn, will submit an investment application to the federal level. It is important to make the following reservations:

- we suppose that the financial performance of the dominant company has a direct impact on the socioeconomic situation in the monotown (salaries, social benefits, and other parameters);

- the federal principal can monitor the situation in monotowns with a probability of  $\alpha$ , therefore it can estimate the company's actual need for additional financing with a probability of  $(1 - \alpha)$ ;

- the regional principal striving to maximise the regional budget and stabilise the socioeconomic situation makes an effort of  $e_1$  to monitor the fulfilment of the company's obligations after receiving additional investment [28]. However, the regional principal can also be characterised by rent-seeking behaviour [23]. Therefore, it is possible that a part of investment  $\gamma f$ ,  $\gamma \in (0; 1)$  will be absorbed by the local principal and a part of investment  $(1 - \gamma)f$  will be transferred to the dominant company. In this case, the company's management owes obligations to the local principal making an effort of  $e_2$  to monitor their fulfilment. Therefore,  $e_2 < e_1$ ;

- the regional principal has necessary information and can report the agent failing to meet their obligations to the federal principal, in their turn, the federal principal can impose sanctions  $s$  and terminate investment over a period of  $t + 1$ <sup>7</sup>.

In view of the above, let us build a probability model. There are following parameters:

$P^F$  stands for the federal principal making investment decisions;

$P^R$  stands for the regional principal, aware or unaware of the agent's unreliability. We will consider a case when the  $P^R$  is aware of the agent's unreliability. Therefore, the former can force the latter to fulfil their obligations with a probability of  $a_2$  allocating the full amount of funding or allocate full amount of funding without forcing the latter to fulfil their obligation with a probability of  $a_3$ . At the same time,  $P^R$  can act as a rent-seeking actor. Therefore, they can conclude a contract with the agent and force them to fulfil its obligations with a probability of  $a_4$  or appropriate part of investment being unaware of the agent's further actions. Here, two relationship systems are possible:

$P^F$  and **Agent** — direct interaction,  $P^R$  and **Agent**,  $P^F$  and  $P^R$ . In the case of direct interaction, the principal monitors the project implementation by

<sup>7</sup> It is supposed that a company cannot be 'revitalised' in a year, therefore one should consider  $T$  periods, where  $t \in (1, T)$  with a one year gap. In this case, if a project was approved and investment made in the period  $t$  but the agent turned out to be unreliable, in the period  $t + 1$ , the investment will equal zero.

the agent in the period  $t_i$ , if the latter fails to fulfil their obligations, the agent will learn about it within the period  $t_{i+j}$  discontinuing investment in the next period  $t_{i+j+1}$ .

However, if we consider the participation of all three actors, the system becomes much more complicated (fig.).

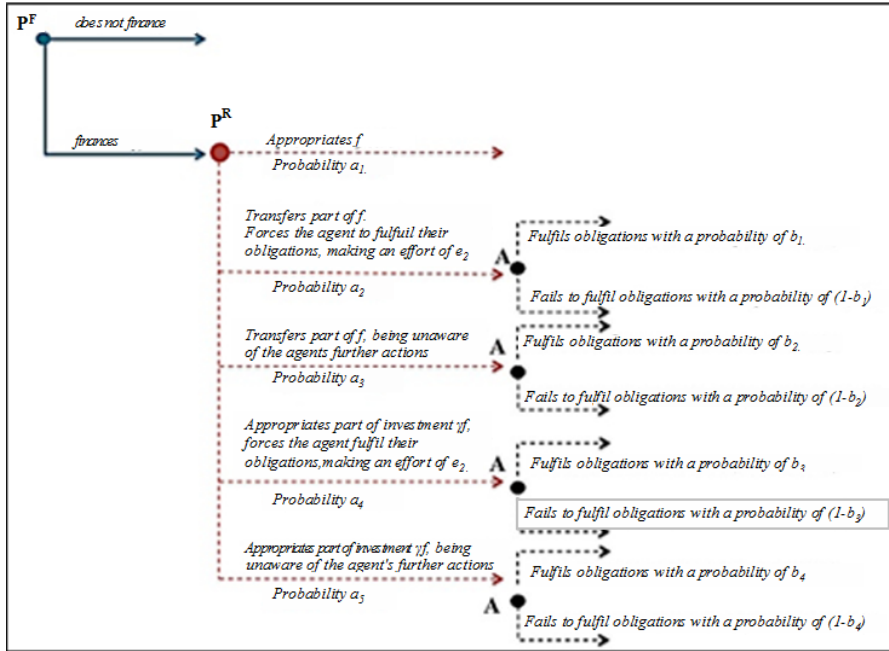


Fig. Possible scenarios within the model

Let us assume that  $\sum \alpha_i = 1$ , where  $I = 1,5$  и  $\sum b_i = 1$ , где  $I = 1,4$  and, due probability distribution,  $b_3 < b_1$  and  $b_4 < b_2$ . It is logical to suppose that the most interesting cases are those where the regional principal transfers the full amount of funding to the agent, forcing the latter to fulfil their obligations and when the principal appropriates part of investment, nevertheless, forcing the agent to fulfil their obligations. The first issue we are interested in is the correlation of the efforts made by the mediating principal in these cases. Is it possible that the mediator's actions will encourage the agent to act according to the first scenario? The second issue is the agent's stimuli for fulfilling their obligations. The sanctions  $s$  are also taken into account. However, they will hardly have a big enough effect to prevent the actors from rent-seeking behaviour. Evidently, the more favourable situation is that with the mediator controlling the agent's actions and the agent's profit exceeding the profit from concluding a contract with the mediator. For the agent, the condition for selecting a strategy (fulfilling obligations) is equivalent to a set of solutions of the inequation  $a_4 b_3 f(1 - \gamma) + \pi < a_2 b_1 f + \pi$ , i.e. if the amount of investment 'appropriated' by the mediator does not exceed  $\gamma > \left(1 - \frac{a_2 b_1}{a_4 b_3}\right) f$ .

Then, assuming that the principal's utility is a certain function  $\xi$  of efforts made to monitor the actions of the agent and some of the significant variables, the area of mutually beneficial cooperation between the principal and agent will be within the set of solutions of the system

$$\begin{cases} \gamma > \left(1 - \frac{a_2 b_1}{a_4 b_3}\right) f \\ \xi \rightarrow \max \end{cases}.$$

In this case, if the functions are given in a particular form and it is possible to identify the threshold values of efforts made by the principle and the agent's 'remuneration', it is important to understand how these efforts can be evaluated in practice. What can become an actual stimulus for them? This situation necessitates examining informal institutions and cases of overcoming the monotown problem within the considered structure of stakeholders. This, however, requires further study.

## Conclusions

Increased activity of both authorities and various initiative groups in the context of the 'monotown problem' requires developing unique methodologies for an empirical analysis of the actual situation in monotowns. One cannot deny the existence of the monotown problem. Of course, it is there, but it is important to understand to what extent it is exaggerated. A clear picture of the problem simplifies the search for relevant solutions.

In this article, we have carried out a quantitative analysis of monotowns based on the existing list of monotowns and their socioeconomic characteristics. The analysis helped obtain the following results.

- Firstly, there is a need for a qualitative approach to selecting parameters taking into account all structural factors reflecting the socioeconomic situation in monotowns. An accurate assessment of the necessary set of parameters simplifies the evaluation of prospects of finding a solution to the monotown problem due to the formation of monotown clusters with similar characteristics; an appropriate approach can be chosen for each cluster;

- Secondly, both availability and accuracy of socioeconomic data can be an issue. When trying to analyse changes in the situation in all monotowns from 2007 to 2014, we had to deal with the absence of data for these years for a large number of monotowns. This is unfortunate, since a panel sample could have become a reference point for developing concepts aimed at solving the monotown problem;

- Thirdly, it is important to consider the ADT status. At this stage, it is impossible to draw any conclusions about the transparency of the principles behind the selection of monotowns entitled to the ADT status. However, one can assume that the possibility of analysing the development of the 'privileged' monotowns in comparison to the rest of them will contribute to identifying key characteristics for acquiring such status and understanding its actual, not perceived, benefits.

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